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March 1978

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CONTROL OF THE MULTIMAMMATE RAT, *Mastomys natalensis* (A. SMITH) IN THE IRRIGATED FIELDS OF THE REPUBLIC OF BURUNDI

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ABSTRACT: Irrigated cultivations have been developed in Burundi with the aid of the European Fund for Development. Three major rodent species are considered pests, but one of them is far more important and can survive flooding: *Mastomys natalensis*, the multimammate rat. The biological cycle of the species is well identified, with peak populations generally in the July-October period. A first attempt to prevent the damages consisted of slight changes in the timing of some cultivations. The second step was to find a rodenticide and a bait that could have practical use in that country. Corn paraffin blocks poisoned with chlorophacinone appeared to be convenient. 80-95% control is obtained with 2-3 kg. bait per hectare.

INTRODUCTION

The European Fund for Development (EFD) has undertaken to support the establishment of a drained and irrigated area, measuring 3000 ha. in the flood-plain of the Ruzizi River, near Lake Tanganika and near Bujumbura, the capital of the Republic of Burundi. The aim was to develop some new food crops, such as rice and corn, and also certain crops of economic importance such as cotton, and recently, coffee.

The "French Company for the Development of Textile Fibers" (CFDT) has taken charge of the initial farming. However, the fields are now cultivated by African farmers who are grouped in several new villages and helped by a national technical and economic organization: the "Regional Society for the Development of the Imbo" (SRDI).

Beginning with the first crops, both rice and corn were heavily damaged by the rodents, so I proposed to the FED and the Ministry of Agriculture of Burundi a three-year program so as to work out a control method.

This paper shows the general results which have been obtained so far.

The studies were conducted beginning in June 1973 until October 1976, with the cooperation of the following individuals: M.M. Guy Chaveau, Chief of the CFDT mission in Burundi; Joel Vissault of the Overseas Scientific and Technical Research Office (ORSTOM); Amédée Raban and later, Marius Affani of the CFDT; and Emmanuel Gahungu and presently Thomas Ntawuharahiciwe, agricultural technicians of the SRDI.

SPECIES

During the field studies, more than ten species of rodents were hand-caught or trapped. But only three are widely distributed, abundant and suspected of damaging the crops: multimammate rat, *Mastomys natalensis* (A. Smith), creek rat, *Pelomys fallax* (Peters), and spotted grass mouse, *Lemniscomys striatus* (L). The first one is present in all parts of the area, flooded or not, but it is especially abundant in the rice field. The other two live in the fallow lands, in the corn, sorghum or cotton fields, but not in the flooded rice fields.

The most important rodent is certainly *Mastomys*. Therefore, it is the main object of the present paper.

ANNUAL BIOLOGICAL CYCLES

It is not possible to present here the mean characteristics of the reproduction and the population dynamics of *Mastomys* in the concerned agrosystem. It is necessary, however, to specify the annual cycles of reproduction and abundance because these two data are fundamental for its control.

We have used a standardized trapping line for the field studies. One line consists of 101 live traps which are placed 5 m apart (the line is 500 m in length). Captured rodents are removed daily for a 5-day period. The trapped animals are sacrificed and examined for size, age, reproductive activity, etc.

The mean number of rodents caught per km of line gives an index to estimate the level of population. The number of females which are pregnant, sucking, or both at the same time, is evaluated. Their index (number/km) gives a good figure of their reproduction at any time.

Figures 1 and 2 represent the mean variation of these two indexes in the rice fields and in the other various cultivated or fallow fields during the two last agronomic years (from October 1974 through September 1976).

At first sight, and in spite of slight differences between the two biota, it is obvious that the annual cycles of *Mastomys* are extremely simple in the studied area.

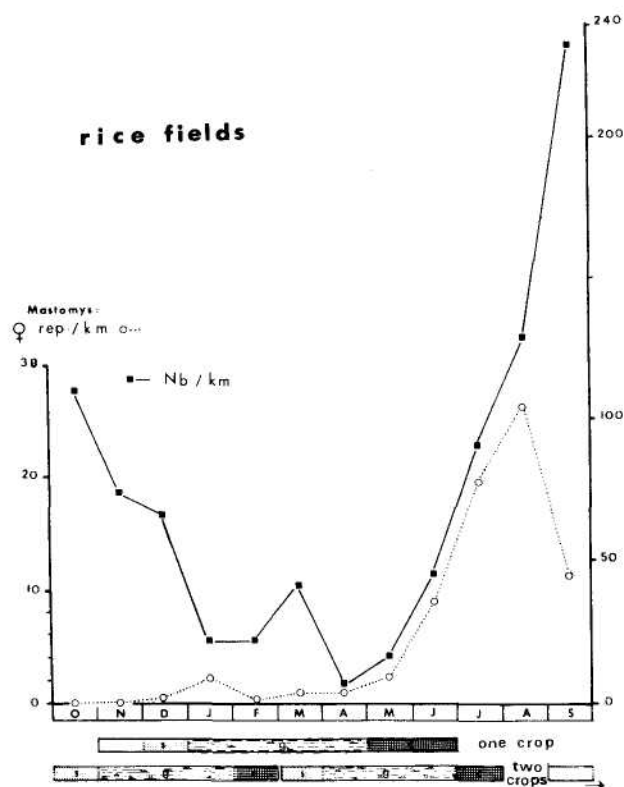


Figure 1.

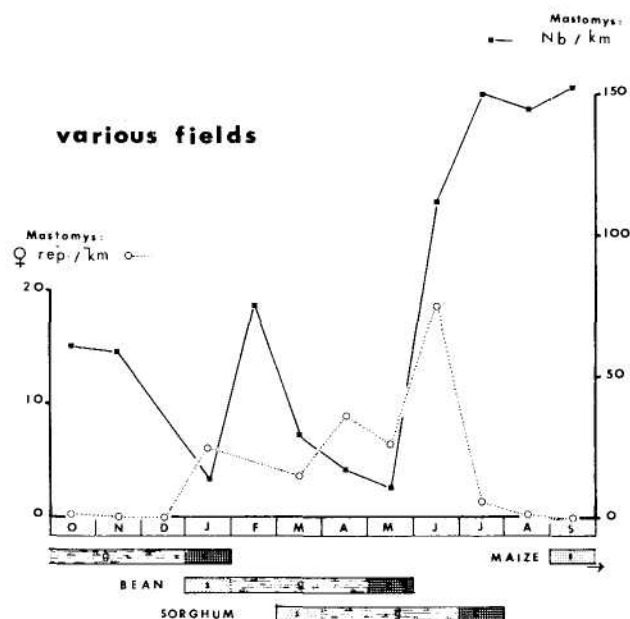


Figure 2.

Previously, numerous authors have described the existence of annual cycles for *Mastomys* and other African *Muridae*. We must note that the timing of these cycles is fairly variable, even for neighboring countries. The present data are different from those published for the Kiwu (Goormans and Christiaensen, 1961; Delany and Neal, 1969) for the Kenya (Neal, 1968). The nearest data are those given for a flood plain of Tanzania (Sheppe, 1972). It is not possible to discuss this matter here, but it is necessary to remember that the phenomenon is variable in time, in relation with many known and unknown ecological factors.

AGRONOMIC ANSWER

At the beginning of the research, I had suggested two immediate measures. First, rice fields are damaged at the last stage when they are about to mature during the month of July, but if sowing is done in November (a very good time from the agronomical point of view), the rice will mature at the end of May or during June, when the level of rodents is too low to cause damage of any economic importance. Second, corn fields were destroyed in 1972 because they matured in August--at the peak of the rodent population, but if the corn is sowed in October, the crop will be ready in January when rodents are at minimal level (but it will be necessary to protect the seeds or have a good method of controlling the rodents at that time).

SELECTION OF RODENTICIDE

It was desirable to avoid, if possible, the use of poisons such as zinc phosphide, because of the direct hazard to humans, cattle, and wildlife. It was also very important to avoid the secondary poisoning of these predator mammals and birds which are numerous in the flood plains: *Ictonyx striatus*, *Poecilogale albinucha*, *Ciconia ciconia*, *Leptoptilos crumeniferus*, *Milvus migrans*, *Aquila rapax*, *Balearic regulorum*, etc.

These predators kill a large number of rodents, especially when the fields are flooded, and, in these instances, their predatory activity is certainly equal in value to successful poisoning.

Table 1 summarizes the data for the tests which were made in the laboratory by Vissault and Raban (1976). It was concluded that chlorophacinone baits, with a concentration of 0.005%, constituted a good rodenticide against *Mastomys*, *Pelomys* and *Lemniscomys*, as it does against *Microtus arvalis* and *Fiber zibethicus* (Giban, 1974).

SELECTION OF BAIT

At the beginning of the studies, only rice was available in the market in Burundi. The laboratory tests, however, demonstrated that these grains, husked or not, are a poor bait for all three species of rodents.

Table 1. Toxicity of anticoagulant bait to three African Muridae in test groups of 9 to 30 animals (from Vissault and Raban, 1976).

Anticoagulant	Chlorophacinone		Coumafene	
Bait Concentration	0.005%		0.025%	
Feeding	1 day	3 days	1 day	3 days
Species:				
<u>Mastomys natalensis</u>	18/30	29/30	1/20	8/19
<u>Pelomys fallax</u>	16/18	20/20	0/9	
<u>Lemniscomys striatus</u>	24/30	28/30	3/20	5/10

On the other hand, the trials made with corn were favorable in the laboratory and in the field. The acceptance and consumption were good, and the success of the first crops in the perimeter saved enough for future poisoning campaigns.

It was necessary to prevent the baits from being eaten in the field by birds. Therefore, after tests were made in the laboratory and in the field, it was recommended that the grains be coated with paraffin to make blocks weighing about 20 g.

The bait formula (adapted from Marsh and Plesse, 1960) is the following:

Corn grains	100 kg
Liquid concentrate at 0.25% Chlorophacinone w/v	2 l.
Paraffin	40 kg.

METHOD OF CONTROL USING POISONED BAIT

Currently (1977 and 1978), the survey of the rodent population is made in the various cultivations of the area. But this is temporary. The CFDT Mission is still in place for some time and it will be necessary to give the African people a standard method that is easy-to-use in every circumstance. Therefore, we have tested during the past years the possible basic data for such a method.

The live trapping with capture and recapture of marked animals was made during two years in many parts of the area. It was thus established that 85% of the recaptures were within 25 m from the point of the first capture. Consequently, it is recommended that bait (one or two blocks) be put every 5 m along lines placed 25 m apart.

From September 1975 until September 1977, 27 field experiments, or practical applications, were made on areas measuring from 40 to 500 ha and at different times of the year. Most of these tests were evaluated by the standard method of trapping, with a comparison of the population index before and after treatment. In some cases, unfortunately, only an empirical estimate was obtained. All these experiments are summarized in a recent paper (Giban, 1977).

CONCLUSION

- A. The use of 2-3 kg of poisoned bait per ha is generally sufficient to obtain a mortality of 85% or more, even at the peak of the population.
- B. It is better to spread this quantity in two treatments, with a delay of 6-8 days between the first and second one.
- C. If the treated area is too small (less than 50 ha), the effect appears low or even null, for the rodents reinvade from the nearest areas and replace the dead ones.
- D. If the treated area is not less than 200 ha, the effect is good and the level of decimated population remains low during the two weeks or more, even if it was very high before the treatment and if the reproduction is not completed.

The control operations, made in September or October in the above-mentioned conditions, were effective (mortality from 80-95%) and provided sufficient protection for the corn seeds.

DISCUSSION

The current situation of the food cultivations is as follows:

Rice. Sown in November, rice is free of damage of economic importance. The possibility of two successive crops is now considered. In this case (Fig. 1) the first crop will surely be free of damage, but the second one will certainly be damaged in July. At this time of the year, it is assumed that the effect of poisoning will be too short; but, the damage caused by the rodents will be of minor importance in comparison with that caused by granivorous birds.

Sorghum and Bean. No damage by rodents is known at the present time. It is curious that a very near species of *Mastomys* is a pest in the bean crops of West Africa. However, a control operation at sowing, or at the flowering time, may be successful with poison baits (Fig. 2).

Corn. The past three years proved that a poisoning treatment made just before the sowing time is sufficient to provide effective protection of the seeds so that damage at crop time is null or negligible.

CONCLUSION

The above are examples that establish that it is possible to protect, effectively, and at minimum expense, the food crops in the irrigated areas in tropical Africa by means of a good program of poisoned baits and by coordinating the agronomical calendar with the biological cycles of the rodents.

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